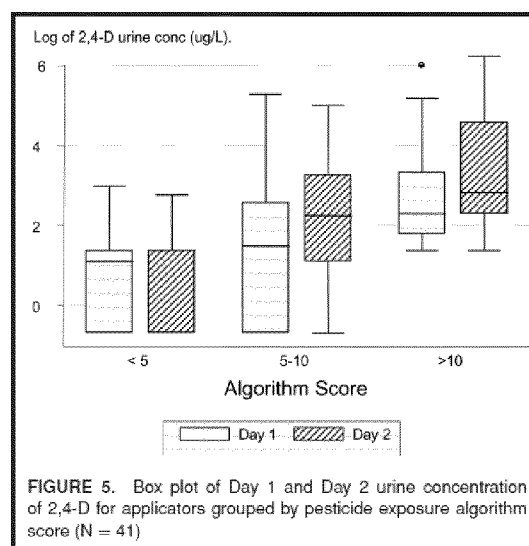
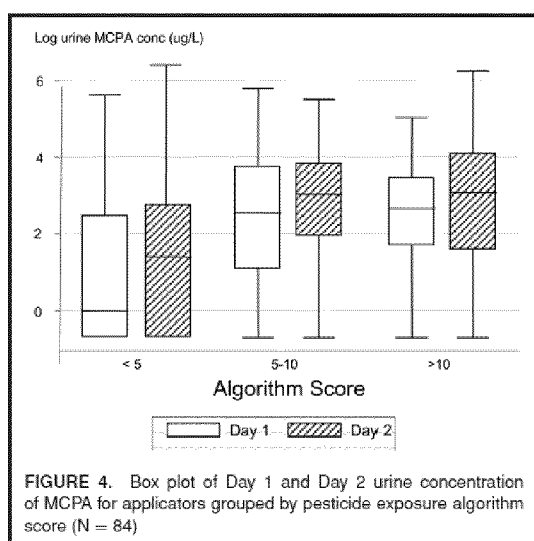


## Exposure assessment for the Agricultural Health Study

A semi-quantitative method was developed based on self-reported information from 58,000 applicators in Iowa and North Carolina on exposure relevant information like mixing condition, duration and frequency of application, application methods, maintenance or repair of mixing and application equipment, work practices, use of personal protective equipment and personal hygiene. For each study subject, chemical-specific lifetime cumulative pesticide exposure levels were derived by combining intensity of pesticide exposure as estimated using self-reported information on determinants of exposure intensity in formal algorithms and self-reported duration/frequency of pesticide use (Dosemeci et al. 2002). Using logic checks the accuracy of self-reported pesticide product use was studied by comparing self-reported decade of first use and total years of use to the year the pesticide active ingredient was first registered for use using active ingredient registration information from the United States Environmental Protection Agency (USEPA) and other publicly available sources for the 52 pesticides on the AHS initial questionnaires administered from 1994 to 1997. The majority of respondents provided plausible responses for both decade of first use and total duration of use (Hoppin et al. 2002).

A more direct validation of the algorithm used to estimate exposure intensity scores was performed through comparison of algorithm scores with biological monitoring data from 84 pesticide applicators who applied the herbicide MCPA and 41 applicators who applied 2,4-D. The concentration of MCPA in urine ranged from < 1.0 to 610 µg/L and concentration 2,4-D in urine ranged < 1.0 to 514 µg /L. A direct comparison of algorithm scores and urine concentrations showed weak correlation especially for MCPA (Spearman correlation 0.17-0.18), and moderate for 2,4-D (Spearman correlation 0.34-0.45). Categorizing the population based on their algorithm scores into three groups showed the geometric mean in the highest exposure group to be 20 µg/L and 5 µg/L in the lowest exposure group for the MCPA applicators. For 2,4 D applicators the geometric means were 29 µg/L in the highest exposure group and 2 µg/L in the low exposure group. (Coble et al. 2005) [The working group noted that these differences seem to indicate reasonable contrast in exposure based on the algorithm score, but the distributions of the urinary biomonitoring values overlapped almost entirely (see figure x) indicating the limited power of the algorithm to assess intensity of exposure.]



The second validation focussed on evaluating the intensity algorithm using actual fungicide exposure measurements from orchard applicators. Personal air, hand rinse, 10 dermal patches, a pre-application first-morning urine and a subsequent 24-h urine sample were collected from 74 applicator for 2 days post application were analysed for the fungicide captan. Environmental samples were analyzed for captan, and urine samples for cis-1,2,3,6-tetrahydrophthalimide (THPI). Captan and THPI were more frequently detected in environmental and urine samples from applicators who used air blast rather than hand application. The exposure intensity algorithm was only marginally predictive of thigh and forearm concentration but did not predict air, hand rinse or urinary THPI exposures (Hines et al. 2008).

A third validation study again compared algorithm intensity scores with measured exposures in the field. Pre- and post-application urinary biomarker measurements were made for 2,4-D (n=69) and chlorpyrifos (n=17) applicators but in addition personal dermal exposure was measured by dermal patches and hand wipes alongside collection of personal air samples. Intensity scores using information from technicians compared to those based on information from applicators were highly correlated (Spearman's  $r=0.92$  and  $0.84$  for 2,4-D and chlorpyrifos, respectively). Correlations between the algorithm intensity scores and post-application urinary concentrations were moderate for both 2,4-D and chlorpyrifos ( $r=0.42$  and  $r=0.53$  respectively). Correlations between intensity scores and estimated hand loading, estimated body loading, and air concentrations were weak to moderate for 2,4-D applicators ( $r$ -values  $0.28$ - $0.50$ ) but lower for chlorpyrifos applicators using granular products ( $r$ -values  $0.02$ - $0.58$ ) (Thomas et al. 2012).

Based on the results of these validation study the algorithm used for the AHS study was modified, but this new algorithm containing modified weighing factors for personal protection efficiency and application method was not validated in a new exposure study (Coble et al. 2011).

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